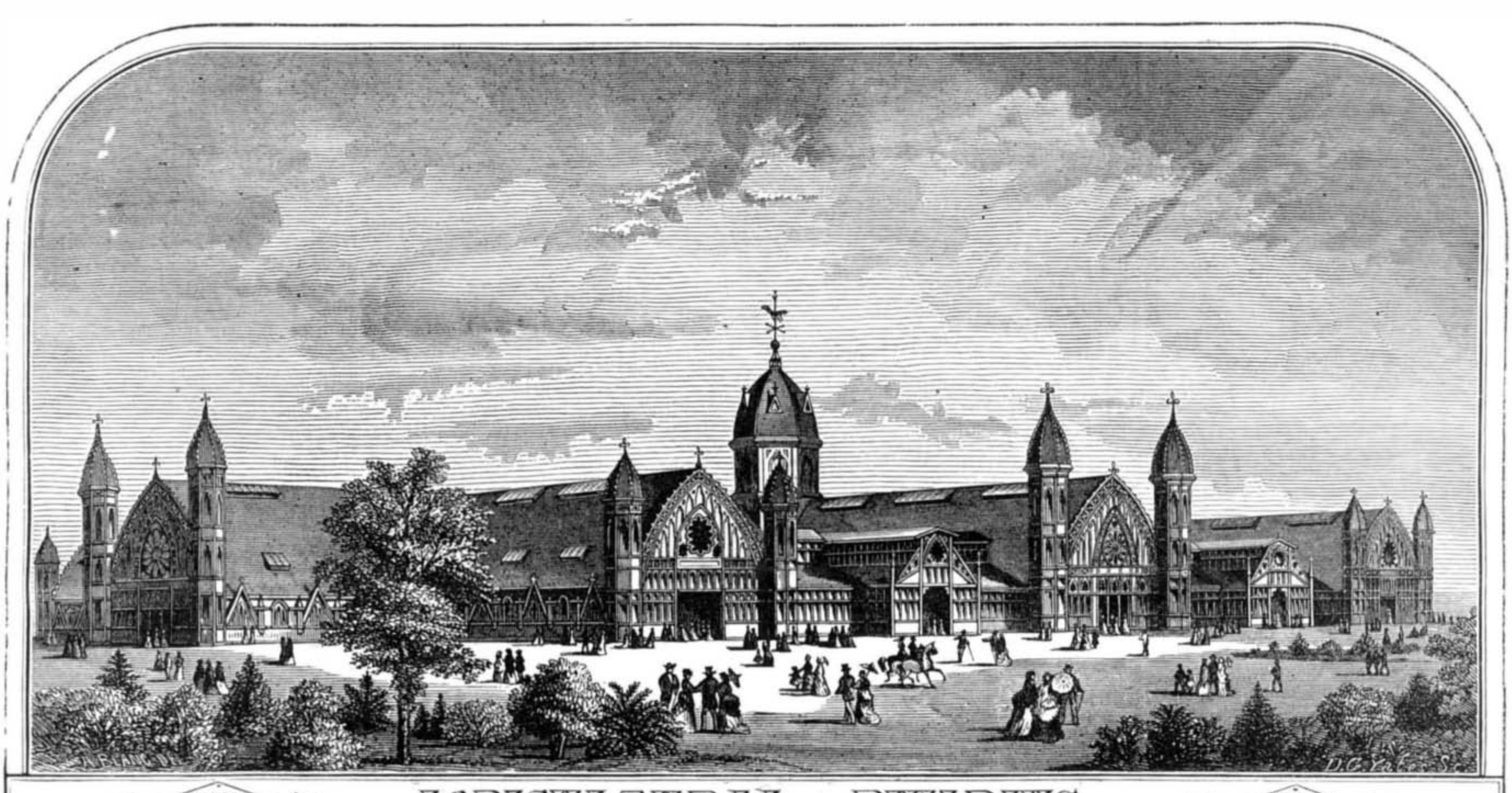
June 22, 1875. For further particulars regarding sale of rights, etc., address the inventor, Mr. William Roberts, Quincy, Adams county, Ill.

THE CENTENNIAL BUILDINGS.

We have already published complete views of three of the buildings now being erected for the purposes of the Centennial Exposition to be held in Philadelphia next year; and we now add a representation of the large structure to be devoted to the agricultural show. It will stand north of the Horticultural Building, and on the eastern side of Belmont avenue, Fairmount Park. It will illustrate a novel combination of materials, and is capable of erection in a few months. Its materials are wood and glass. It consists of a long nave crossed by three transepts, both nave and transept being composed of Howe truss arches of a gothic form. The nave is 820 feet in length by 125 feet in width, with a hight of 75 feet from the floor to the point of the arch. The central transept is of the same hight, and has a breadth of 100 feet, the two end transepts being 70 feet high and 80 feet wide.

The four courts inclosed between the nave and transepts, and also the four spaces at the corners of the building, having the nave and end transepts for two of their sides, will be roofed to form valuable spaces for exhibits. Thus the ground plan of the building will be a parallelogram of 540 by 820 feet, covering a space of above ten acres. In its immediate vicinity will be the stock yards for the exhibition of horses, cattle, sheep, swine, poultry, etc.

Several foreign countries will erect buildings, more or less important in size and appearance, in the park. These will add importantly to the appearance of the whole, and many of them will be attractive specimens of modern architecture. Altogether, the Commission must be congratulated on their success in obtaining the necessary buildings for the Exposition.



1776 AGRICULTURAL BUILDING. 1876

Progress of Engineering.

At the meeting of the British Association for the Advancement of Science, which took place at Bristol on the 25th ult. Sir John Hawkshaw delivered the address, devoting himself especially to the history and progress of engineering. "Inventions," he said, "were lost and found again. The art of casting bronze over iron was known to the Assyrians, though it has only lately been introduced into modern metallurgy; and patents were granted in 1609 for processes connected with the manufacture of glass which had been practised centuries before. An inventor in the reign of Tiberius devised a method of producing flexible glass, but the manufactory of the artist was totally destroyed in order to prevent the manufacture of copper, silver and gold from becoming depreciated.

ANCIENT ENGINEERING.

A high tribute to the wonderful engineering capacities of the Romans was paid by Sir John. Wars, with all their attendant evils, often indirectly benefited mankind, as when, under the Romans or Napoleon, great systems of roads and bridges were instituted for military purposes. Roads followed the tracks of Rome's legions into the most distant provinces of the empire. Three hundred and seventy-two great roads are enumerated, together more than 48,000 miles in length, according to the itinerary of Antoninus. The water supply of Rome during the first century of our own era would suffice for a population of 7,000,000, supplied at the rate at which the present population of London is supplied. A rapid glance was taken at the progress of mechanical skill in the manufacture of textile fabrics and the immense growth of steam traffic on the ocean, traffic which a distinguished member of the association had said, at one of its meetings, forty years ago, was impossible. Similar advancement has been recorded in the department of telegraphy; and what a splendid success had not the railroads proved! The railways in the British islands now produce, or rather save to the nation, a much larger sum annually than the gross amount of all the dividends payable to the proprietors, without at all taking into account the benefit arising from the saving in time. The benefits under that head defy calculation, and cannot with any accuracy be put into money: but it would not be at all overestimating this question to say that in time and money the nation gains at least what is equivalent to 10 per cent on all the capital expended on railways. It follows that, whenever a railway can be made at a cost to yield the ordinary interest of money, it is in the national interest that it should be made.

COMPARATIVE SAFETY OF RAILWAYS.

Speaking of accidents on railways, Sir John said that they were fewer now than they had been; indeed, that there is only one passenger injured in every 4,000,000 miles traveled, or that, on an average, a person may travel 100,000 miles each year for forty years, and the chances be slightly in his favor of his not receiving the slightest injury.

TEXTILE INDUSTRIES.

More ingenuity and creative mechanical genius is perhaps displayed in machines used for the manufacture of textile fabrics than by those used in any other industry. It was not until late in historical times that the manufacture of such fabrics became established on a large scale in Europe. Although in China man was clothed in silk long ago, and although Confucius, in a work written 2,300 years ago, orders with the greatest minuteness the rules to be observed in the production and manufacture of silk, yet it was worth nearly its weight in gold in Europe in the time of Aurelian, whose empress had to forego the luxury of a silk gown on account of its cost.

Until 1738, in which year the improvements in spinning machinery were begun, each thread of worsted or cotton wool had been spun between the fingers in this and all other countries. Wyatt, in 1738, invented spinning by rollers instead of fingers, and his invention was further improved by Arkwright. In 1770 Hargreaves patented the spinning jenny, and Crompton the mule in 1775, a machine which combined the advantages of the frames of both Hargreaves and Arkwright. In less than a century after the first invention by Wyatt, double mules were working in Manchester, with over 2,000 spindles. Improvements in machines for weaving were begun at an earlier date. In 1579 a ribbon loom is said to have been invented at Dantzic, by which from four to six pieces could be woven at one time, but the machine was destroyed and the inventor lost his life. In 1800 Jacquard's most ingenious invention was brought into use, which, by a simple mechanical operation, determines the movements of the threads which form the pattern in weaving. But the greatest discovery in the art of weaving was wrought by Cartwright's discovery (in 1784) of the power loom, which led eventually to the substitution of steam for manual labor, and enabled a boy with a steam loom to do fifteen times the work of a man with a hand loom.

For complex ingenuity few machines will compare with those used in the manufacture of lace and bobbin net. Hammond, in 1768, attempted to adapt the stocking frame to this manufacture, which had hitherto been conducted by hand. It remained for John Heathcoat to complete the adaptation in 1809, and to revolutionize this branch of industry, reducing the cost of its produce to one fortieth of what the cost had been before Heathcoat's improvements were effected.

TELEGRAPHY.

There is no more remarkable instance, of the rapid utilization of what was in the first instance regarded by most men as a mere scientific idea, than the adoption and extension of the electric telegraph.

The first useful telegraph was constructed upon the Blackwall Railway in 1838, Messrs. Wheatstone's and Cooke's instruments being employed. From that time to this the progress of the electric telegraph has been so rapid that, at the present time, including land lines and submarine cables, there are in use in different parts of the world not less than 400,000 miles of telegraph.

Among the numerous inventions of late years, the automatic telegraph of Mr. Alexander Bain, of Dr. Werner Siemens, and of Sir Charles Wheatstone are especially worthy of notice. Mr. Bain's machine is chiefly used in the United States, that of Dr. Werner Siemens in Germany. In Great Britain the machine invented by Sir Charles Wheatstone, to whom telegraphy owes so much, is chiefly employed. By his machine, after the message has been punched out in a paper ribbon by one machine, on a system analogous to the dot and dash of Morse, the sequence of the currents requisite to transmit the message along the wire is automatically determined in a second machine by the perforated ribbon The second operation is analogous to that by which, in Jacquard's loom, the motions of the threads requisite to produce the pattern are determined by perforated cards. By Wheatstone's machine, errors inseparable from manual labor are avoided; and what is of even more importance in a commercial point of view, the time during which the wire is occupied in the transmission of a message is considerably diminished.

By the application of these automatic systems to telegraphy, the speed of transmission has been wonderfully accelerated, being equal to 200 words a minute, that is, faster than a shorthand writer can transcribe; and, in fact, words can now be passed along the wires of land lines with a velocity greater than can be dealt with by the human agency at either end.

Owing partly to the retarded effects of induction and other causes, the speed of transmission by long submarine cables is much smaller. With the cable of 1858 only 2½ words per minute were got through. The average with the Atlantic cable, Dr. C. W. Siemens informs me, is now 17 words, but 24 words per minute can be read."

Steam at 500 lbs. Pressure.

For several years the successful experiments of Mr. Loftus Perkins, in England, in the use of steam at enormous pressures, rising as high as 500 lbs. per square inch, have been known, but the explanations for the delay in the manufacture have not until now been made public. It appears, from the law proceedings in a suit lately brought by Mr. Perkins against the Yorkshire Engine Company, that Mr. Perkins assigned the exclusive license under his patents to the Company, they in turn agreeing to proceed with the building of the new engines and boilers forthwith. But this the Company failed to do, and so the invention became as it were locked up, and Mr. Perkins was compelled to appeal to the courts for relief. The case recently came on before Justice Fields, Nisi Prius Court, Leeds, when the following interesting explanation was elicited:

In opening the case, Mr. Wills said that his client, Mr Loftus Perkins, was a civil engineer, who resided in London. He was the inventor and constructor of various devices for the improvement of boilers and engines, which were the subject of several patents; and the defendants were the Yorkshire Engine Company, Limited, which company traded principally in the manufacture of locomotive engines, and carried on their business in the neighborhood of Sheffield. The action was brought upon an agreement entered into between the plaintiff and the defendants on the 31st of March, 1872. The great object, or rather the principle, which lay at the root of the various improvements invented by Mr. Perkins were, in the first place, the use of extremely high pressure steam; and in the second place, the use of fresh soft water distilled over and over again with the minimum of loss, so that, practically, there was but little replenishing of the original supply necessary. The investigation of the profitable application to mechanical purposes of extremely high pressure steam was a matter which had been hereditary in the family of Mr. Perkins, for his grandfather was the inventor of what was scarcely more than a toy—an extremely ingenious toy, which was well known thirty or forty years ago, and which he (Mr. Wills) recollected seeing in his boyhood, and which some of the jury might have seen, exhibited in the Polytechnic, in London—Perkins' steam gun—in which by high pressure of steam, the result which was ordinarily got from the explosion of compounds was secured. Mr. Perkins had followed in the footsteps of his grandfather and father, and he became convinced many years ago that great economy would result both in wear and tear, and that there would be great economy of fuel, by the use of high pressure steam—steam with many times the amount of pressure that was ordinarily used in high pressure engines. The first thing which became necessary was to construct a totally new kind of boiler, because it was obvious that boilers of the ordinary construction never could stand such pressure as Mr. Perkins wished to put upon them, namely, from 200 to 300, and even up to 500 lbs. per square inch. Accordingly, Mr. Perkins conceived the notion of making these boilers tubular, and making them tubular in exactly the inverse sense in which we generally understand a tubular boiler. In an ordinary tubular boiler the tubes which carried the heated air passed through the boiler and were surrounded by the water which was to be turned into steam. By Mr. Perkins' process this was reversed. The heated air was carried outside the tubes, and the water to be turned into steam was placed within the tubes. Mr. Perkins constructed tubes with a diameter of three inches, and with tubes of that diameter the necessary strength was practically attainable. The tubes were tested by hydraulic power up to 3,000 lbs. per square inch, and no tube was used which did not undergo that pressure. Mr Perkins thus over came one difficulty, and he was thus able to get the means of obtaining safely, within the walls of iron, the water which was necessary to produce this very high pressure. That idea once grasped, a great practical difficulty occurred, namely, that of fastening tubes of this sort into plates which must hold them, and maintain the necessary connection between these tubes in such a manner as to be as strong as the tubes themselves. The first patent which formed the subject of agreement in this case was taken out on the 27th of April. 1868, and was for improved means of fastening these tubes—connecting them together and fastening them in the plates, which would also hold them. Mr. Wills went on to explain the method by which the tubes were fixed to the plates, and then said the next difficulty was a very formidable one. Steam at that pressure had a temperature of something like 450 or 500 degrees Fah., within a few degrees of the temperature at which metal became red hot, and a cylinder into which the steam was to be introduced must be worked without any vegetable matter about it, or it would have been impossible to work it. This difficulty was overcome by the construction of a double cylinder, of the form of which the jury could have an idea if they thought of a fig drum with a large marmalade pot on the top of it. The upper cylinder, represented by the marmalade pot, had no communication with the external air. The upper cylinder needed no stuffing box. The bottom of it was always filled up by the piston. The steam at 500 lbs. pressure, or the water that was to be let into the upper cylinder there, did its duty at that high pressure, never finding its way at all into the lower cylinder. As soon as it did its work the steam was let out by a system of mechanical valves in to a larger cylinder, and arrived there at greatly diminished pressure, which it was safe to use with the ordinary mechanical appliances for stuffing boxes. The upper cylinder was the only part in which the high pressure steam was introduced.

His Lordship—What did it do, there?

Mr. Wills—It pushed the piston down, but never did the up stroke. After the steam had done its work at a pressure of, say, from 50 lbs. to 70 lbs. per square inch in the larger cylinder, it went, by virtue of an arrangement which was not new, which Mr. Perkins laid no claim to, but which was called the compound engine system, to another cylinder larger still, where the pressure was from 20 lbs. to 25 lbs. per square inch. After doing the work there, the steam was taken away in the ordinary course of things into the condenser. The condenser, again, was a peculiarity of Mr. Perkins' invention. By this system the condensing of the steam was effected in tubes just as in the boiler, the result being that it absolutely prevented all chance of the admixture of water, and also prevented the escape of steam, so that it could be used over and over again with an amount of waste which was incredibly small. By means of this system marine engines which had to use salt water could be supplied with fresh water, a few tubs being amply sufficient to supply the waste in long voyages. There was also an enormous economy in the consumption of fuel, Mr. Perkins being able to construct the largest engines so as to consume only about $1\frac{1}{2}$ lbs. of fuel per horse power per hour. That was one source of economy. The consequence of using the same water over and over again in this way was that they could start with distilled water—the purest water that could be got—and grit or impurities, which became elements of danger in boilers, were prevented from getting in. In the case of marine boilers and engines this was a very important result. It rendered it absolutely unnecessary to depend upon salt water for the supply of the boiler, salt water being a source of enormous loss, because, from the moment it got into the circulating cistern to the moment it left it, it was a source of attack upon the integrity of the metal. Wherever it got, it corroded and ate away the boiler. It also worked in another way, because it gave a great deposit of saline matter, which became incrusted at the bottom of the boiler, and did great mischief by forming an impervious non-conducting coating inside the boiler. The incrustation became as thick as the boiler plate itself, and made the application of the fire heat to be effected under circumstances of enormous disadvantage. The practical result of that was that the life of an ordinary seagoing steam boiler, in large steamers, was from five to seven years, but there might be exceptional cases in which it lasted ten years. Boilers made by Mr. Perkins had been submitted to the most rigid test by officers of the Admiralty, and it was satisfactorily proved that they had been thirteen years in use without repair or alteration of any kind. Mr. Perkins having invented and perfected this arrangement, and having had it satisfactorily used in 1868, he took out the first patent. Mr. Perkins was not a man of boundless means. He was a gentleman who, in company with his father, was carrying on a profitable business in supplying apparatus for heating private houses and churches, in which this new tubular principle had been brought to bear. He had constructed five or six of these engines for himself, one of which was placed in a steam tug, and had been working ever since. But it was impossible for him to construct these engines at a price which would make them a commercial success, and he looked about him for a person who was possessed of the necessary capital. He was introduced to persons connected with the Yorkshire Engine Company, Limited—a company well adapted for his purposes if they had faithfully carried out their promise. They had large premises, and turned out a locomotive a week, which meant a turnover of $750,000 a year at least. They had a capital of $1,000,000, and had power to increase that capital to $2,500,000, therefore it was no imprudent step if he was deluded into the belief that the company would make the invention a success. Accordingly, on the 31st of March, 1872, after six months' preliminary investigation, during which these gentlemen had full opportunity of satisfying themselves of everything connected with the practical character of the invention, a deed was entered into. and it was upon that that Mr. Perkins' complaints were founded. Under that deed Mr. Perkins agreed to give these gentlemen an exclusive license to work his patent, and shut himself out from the possibility of working with other people. They covenanted that he should have 10 per cent royalty upon all articles manufactured and sold by them under the patent. They covenanted to proceed with the manufacture of engines and to set up such extra machinery as might be necessary for the purpose of executing orders. The very first thing that was necessary was to construct sample engines. They agreed that before September, 1872, they would construct two traction engines—one single and the other double. They also agreed, before the 1st January, 1873, to construct a marine engine, of 250 horse power nominal, suitable for a steamer. The first of these engines, a single traction engine, was constructed many months after the reasonable period allowed for its construction, being finished in December, 1873. But it would not work. It never has been worked, and it was broken up, and sold for old iron. The company proposed that, instead of constructing a double traction engine, they should construct instead a locomotive with tram-car attached, suitable for trams in England or abroad. Mr. Perkins assented, but with a strong remonstrance. The engine had never been completed. It had never been put upon the stocks, not a sixpence had been spent upon it, and no attempt had been made to carry it out. With regard to the construction of the marine engine. Mr. Sacre, the manager of the company, wrote to Mr. Perkins on the 10th of July, 1872, three months after the contract should have been begun to be carried out, in which he stated that he had endeavored in every possible way to arrange for a ship to fit the engines to, but without success. The engines would require a steamer of 2,000 tons burden, and as steamers of that burden carried a large number of passengers, an objection was raised as to trying engines of such an experimental character. They proposed to construct an engine of 120 horse power, and they undertook to supply a steamer as well as the engine. Mr. Perkins accept the modification, but complained of the loss of time in carrying out the agreement.

His Lordship (interrupting) asked what was the case for the defence.

Mr. Seymour said their case was that everything that could reasonably be expected had been done, and that difficulties arose——

His Lordship said there was a clear breach in point of time. It was a very valuable invention, and this agreement was made in 1872; we were now in 1875, and nothing had been done.

Mr. Seymour said his Lordship had not heard the history of the difficulties they had had to meet; at one time difficulties with regard to Board of Trade certificates for ships; at another time difficulties with regard to packing, in which Mr. Perkins had himself shared. The packing under this high pressure was exposed to a great strain, and some new invention must be perfected, and it was not till January, 1875, that that difficulty was finally overcome, by a simple but grand discovery on the part of Mr. Perkins and Mr. Sacre. They had now an order from the Admiralty for marine engines, which were being made, and Mr. Perkins wrote a letter speaking of the Admiralty order as putting this machinery on its trial, and the result would be to satisfy the Government as well as the public of the great value of the invention.

His Lordship asked if they could not meet together and arrange the matter amicably?

Mr. Wills said that if the defendants would relieve the plaintiff of the exclusive license they would have a license on most favorable terms. But the plaintiff would do nothing unless he got rid of that exclusive license. He was still in the hands of the Yorkshire Engine Company.

After some further conversation,

His Lordship suggested that counsel should speak to him privately, saying 14 years was the life of an inventor, and three and a half had gone already.

Some further conversation took place, and afterwards his Lordship and the counsel retired. Subsequently it appeared that the Company agreed to a new arrangement, satisfactory to the court and the plaintiff.

The New Jetties at the Mouth of the Mississippi River.

The Board of Engineers, appointed under the act of Congress to promote the improvement of the mouth of the Mississippi river, recently held several important sessions in this city, during which the plans of Captain Eads, of St. Louis, were carefully discussed and in the main adopted. The plan involves the construction of extensive lines of jetties along the courses of the moving water, the jetties being simply dykes or levees under water, which are intended to act as banks to the river, to prevent its expanding and diffusing itself as it enters the sea. It is a notable fact, he says, that where the banks of a river extend boldly out into the sea, no bar is formed at the entrance. It is where the banks are absent, as is the case in delta-forming rivers, that the bar is an invariable feature. The bar results from the diffusion of the stream, as it spreads out, fan-like, in entering the sea. The diffusion of the river being the cause, the remedy lies in contracting the stream or in preventing the diffusion. A glance at the map of the Southwest Pass reveals the narrow and uniform width of the pass until it is within about $7\frac{1}{2}$ miles of the bar, which is three miles beyond the Land's End. In this $7\frac{1}{2}$ miles, the river is building up and extending its own banks into the sea at the rate of eight inches per day. Its jetties are completed by its own forces, and Captain Eads thinks they will probably never change their location, although every time the stream overflows there fresh deposits will raise them still higher. He points, therefore, to the fact that the river itself is continually employing the jetty system, and that Nature makes parallel not converging, jetties. At $7\frac{1}{2}$ miles above the bar of the Southwest Pass, the natural jetties are finished, and narrowed to their normal width of 1,250 feet, and there the Pass is 60 feet deep in consequence. Captain Eads thinks that the bar was once unquestionably where this depth of 60 feet now exists. From this point the river gradually widens out to the sea, and the current gradually diminishes from $4\frac{1}{2}$ feet to about 3 feet per second at the bar, and to zero some twenty miles beyond in the Gulf. Since man has known the Mississippi, this distance between the bar and the narrow banks of the Pass above has been the same, $7\frac{1}{2}$ miles. For 11 miles above, the Pass presents the same narrowness and depth. The bar, says Captain Eads, has marshalled the way through ages past to the Gulf, and the natural jetties have been built up at exactly the same rate of speed, and have constantly kept the bar $7\frac{1}{2}$ miles in advance. As the natural jetties advance, the bar is slowly eroded away.

Now, says Captain Eads, suppose that, by artificial means, these natural jetties could be suddenly extended $7\frac{1}{2}$ miles out to the bar. The volume of water would be almost if not exactly the same, and so would be the current. Instead of passing over the bar as it now does at three feet per second, it would pass out between these artificial jetties at the rate of over four feet per second. The question is, could the bar re-form again afterward, nearer than $7\frac{1}{2}$ miles from the end of these artificial jetties? Suppose there were no litoral current or Gulf Stream to carry away the sediment, the bar would certainly form again, but at the rate it has been going for the last 40 years it would take the river 65,000 days or 178 years to extend its jetties from the place where they are finished out to the present crest of the bar. If man, therefore, should do in three or four years what will require the river 178 years to do, it will be after the lapse of centuries when the bar can reappear, because it must be located at least seven miles beyond the artificial jetties. This argument was made as to the Southwest Pass, but applies with equal force to the South Pass, where he is building the jetties.

Captain Eads further stated that the permanence of these jetties will depend mainly on the skill and experience of the engineers. The river itself is daily showing that it is able to construct jetties of sedimentary matters which it transports, which are imperishable and constantly increasing in strength. On its banks are found millions of young willows and poplars, which, properly formed into fascines and securely interwoven in large masses, and sunk with stone in the line of the proposed jetties, and securely held in position by huge blocks of concrete, will soon become filled with sedimentary deposit, and form artificial banks, indestructible as those Nature is daily building at the passes.

The following is a table of the increase of depth in 18 rivers in Europe where jetties have been effective ;

Names of rivers.	Country.	Original depth, feet.	Present depth feet.
Danube	Roumania (Turkey)	7 to 11	20½ to 21½
Maas	Holland		17 to 18
Trave	Prussia	7	18
Oder	Prussia	7	23 to 24
Warne	Prussia	6	13
Wipper	Prussia	4	13
Persante	Prussia	4	15
Pregel	Prussia	12	20
Stolpe	Prussia	4	14
Niemen	Prussia	10	23 to 24
Leban	Russia	6	16
Dvina	Russia	6	18
Wendora	Russia	4	9
Pernan	Russia	3	12
Nissa	Sweden	5	12
Konno	Sweden	6	9
Altra	Sweden	6	9
Grenaa	Denmark	5	13

A Model Scientist.

The late W. F. Henwood, F.R.S., the distinguished mining geologist, who died at Penzance recently in his seventy-first year, was originally a clerk in the employment of Messrs. Fox, of Falmouth, to whose counsel he was considerably indebted in his early scientific work. By very great industry and careful observation he acquired an unsurpassed knowledge of the mineral deposits of Cornwall and Devon; and after fulfilling a succession of important mining appointments, he became assay master of tin to the Duchy of Corn wall. This post being abolished, Mr. Henwood's great experience was utilized in reporting upon and developing a number of mining districts in South America, Canada, etc.; and after the cessation of his travels, he lived at Penzance in comparative retirement. His great works are the fifth and eighth volumes of the "Transactions of the Royal Geological Society of Cornwall," devoted respectively to the metalliferous deposits of Cornwall and Devon, and to those of the foreign countries he had visited. But his scientific writings besides these were very numerous; a list of them occupies seven columns in the *Bibliotheca Cornubiensis*.

As a scientific man Mr. Henwood was characterized by indefatigable labor, great caution, love of accuracy, and moderation of expression. In his publications he scarcely ever mentions a fact of any kind which had not come under his own experience, without giving the authority for it. Thus many of his writings are marvels of copious reference. He persisted in doing everything with this extraordinary amount of labor and care up to the last, notwithstanding that he suffered for many years from a very painful heart disease. His scientific work ceased only with his death. So long as he could sustain even an hour's intellectual effort during the day, that was devoted to the arrangement of his stores of facts and observations. Scarcely one of his cherished objects in this respect remains unfulfilled.

In personal character Mr. Henwood won the high regard of all who knew him intimately. His acquaintance with men and manners was so great and varied, his memory so retentive, and his conversational style so simple and lucid, that to talk with him was one of the most delightful and instructive of intellectual recreations. His estimate of his own labors and merits was unaffectedly modest, although he would resist, if possible, any unfair representation of his work.

In the spring of the present year the Murchison Medal of the Geological Society was awarded to Mr. Henwood.—*Nature*.

Edible Birds' Nests.

Edible birds' nests are found for the most part in the Southern Archipelago. The chief region of supply is that comprising Java, Borneo, Celebes, and the Sulu Islands. The bird which produces the nests is a little swallow, *hirundo esculenta*. This salangan swallow, as it is called, is slightly bigger than a blue tit; it has a brown back; but the under surface of its body, as also the extremities of the feathers in its forked tail, are white. It flies with wonderful speed and precision; and on the Java coast, where the surge breaks wildly against the precipitous and caverned walls of rock, the little birds may be seen in swarms darting hither and thither through the spray. They probably feed on fragments of molluscs and other small animals which abound on those coasts. As you watch the surface of the water rising and falling, you notice how the holes in the rock are now concealed, now open again; and the little creatures, watching their opportunity, dart in and out with lightning speed. Their nests are fixed to the arched roof of these caverns.

What sort of a thing, then, is the edible bird's nest that ministers to the taste of the luxurious Chinese? It is that portion of the fabric which serves as a sort of bracket on which the nest itself (made of grass, seaweed, fibers, small leaves, etc.) is built. There are two forms of this support, one flat like an oyster shell, the other deep and spoon-shaped. It is a transparent mass, somewhat like isinglass, mother-of-pearl, or white horn, and is of animal origin. It was formerly supposed that this gelatin-like mass might be prepared in the bird's crop, from seaweed and other marine plants. This, however, is a mistake. If one opens the animal's stomach about the time of building, it is found to contain insects, but no vegetable matter; moreover, in all species of the family of swifts, the crop is wanting. Dr. Bernstein has found that at that season the salivary glands under the tongue are enormously developed. On opening the bill, they are seen as two large swellings, one on either side, and these chiefly supply the material in question. They secrete a viscid mucous substance, like a concentrated solution of gum arabic, which can be drawn out of the mouth in long threads; and in the air, it soon dries, and is found to be the same (even microscopically) as the bracket material.

When one of the little birds wishes to begin building, it flies repeatedly against the selected spot, pressing each time a little saliva aginst the rock with the tip of its tongue. This it will do from ten to twenty times, moving away not more than a few yards in the intervals. It then alights, and arranges the material in semicircular or horseshoe form on the rock, continuing to add saliva; and by the motions of its body from side to side, the yet soft saliva is forced out over the harder parts, producing those peculiar undulatory bands which give the nest a stratified appearance. It is thought not unlikely that part of the secretion used by the bird comes from the largely developed glands in its stomach; also, that gelatinous matters picked up in the surge are employed in the construction of its nest. The salangan never uses the same nest more than once, and that for only a month; and after the young brood is flown, the nest soon decays and falls to pieces.

We have now to consider the adventurous work of gathering the nests. The plucker, with nothing on but a cloth round his loins, and with a knife and a netted bag at his side, takes his place on a stage (of two crossbars) fastened to the end of a rope, and is let down against the face of the precipitous rock. With the left hand he grasps the rope; in the right, he has a rod, with which he holds himself as far as possible from the rock. Thus he descends, often several hundred feet, amid the roar of the breakers and the swarming of innumerable birds. When he has come opposite a salangan hole, he makes a signal, and the lowering is stopped. He now sets himself swinging—and here follows the most dangerous part of the operation—gradually increasing his width of swing, till he thinks he will be able to leap off into the hole, and find foothold on a part of the rock which he has previously noted. Should the venture fail, death is certain. The man has generally a thin cord fastened round his body, and connected with the rope, so as to enable him to pull the stage to himself again. Sometimes, though rarely, this breaks, and then there is nothing for it but to make a bold spring out towards the dangling stage. But so fearless and practised are the men that they generally accomplish this fearful leap successfully, even when laden with their booty. When the plucker has got safely into the hole, he cuts off the nests with his knife, and puts them in his bag; for those high up, he uses the rod with the knife fixed to the end of it. The operation demands great address; the slippery rock, perhaps, hardly affords standing ground, and the man will cling with hand and feet to the little cracks or projections; while the alarmed birds flit to and fro in the gloom, and the tumultuous water beneath flashes with phosphorescence. The plucker, however, knows his work; and when he is sufficiently laden, he draws the stage towards himself, mounts it, and is pulled up by his companions. Thereupon, another repeats the operation.

As the method just described is both a dangerous and a slow one, the natives adopt, when possible, another, which consists in fixing a rope ladder from the top of the rock down to the cavern, and also a sort of hanging bridge of rope within the cavern, either running round the wall or passing across. The internal surface of the cavern is often greatly pitted by the action of the weather, presenting a spongy appearance, so that it is not difficult to find points for attachment of the ropes. All the young birds and eggs found are cruelly thrown into the sea. The best harvest is in the months of July and August; the next best, in November and December; the worst, in April and May. The collected nests are cleaned and assorted; they are first packed in bags of bamboo fiber or palm bast, and the merchants again pack them for the market (after a second assortment) in cases containing a half picul, or seventy pounds.

China is the only considerable recipient of these cases; the few cases which are brought as a curiosity to Europe and America are hardly worth mention. The greatest trade in birds' nests is done with Canton, the entire import there being reckoned at 168,000 lbs. We may reckon on fifty nests to the pound, so that altogether 8,400,000 nests, or, from three pluckings, the products of 2,800,000 pair of birds, are annually introduced into China. There are, principally, two kinds of nests distinguished in Canton—the mandarin nests, and the ordinary; of the former or perfectly white kind, each pound costs in China twenty to thirty dollars, a quite exorbitant price, compared with that which the salangan pluckers themselves receive for the dangerous work, and which is, at the most, only ten to twelve per cent of the market value. The second quality of nests are sold at half that price. The nests are dissolved in water or broth, and so taken as soup. It is highly spiced with minor substances. This forms an *entrée* which is rarely wanting on the tables of the wealthy Chinese, and never from that of the imperial court of Peking. The Chinese set a high value upon it, considering it one of the best stimulants; but for this opinion there seems to be little or no ground. The most recent analysis of the nests we owe to Professor Troschel of Bonn. He finds that the material does not consist of specially nourishing or stimulating substances, but is quite similar in constitution to any animal saliva. Thus the Chinese pay dearly for what has really no intrinsic value.—*Chambers' Journal*.

The Water Shell.

A correspondent writing from Okehampton, England, where some artillery experiments have recently been made, states that the trials have been successful in proving the great value of the new water shell, which will at once be adopted as a service weapon. The effects of this novel instrument of warfare surpass in destructive power the renowned Shrapnel shell; and in one experiment when a battery of the Royal Horse Artillery was in action, as many as fifty-one hits were recorded with the new shell, against twenty-eight made by the Shrapnel, fitted with time fuses. The wooden dummies, which represented the enemy drawn up in loose order, one pace apart, in the manner of an advancing army, were struck again and again by the minute fragments of the water shells, which, according to our correspondent, inflicted wounds of a far more dangerous nature than those made by the Shrapnel or common shell.

The nature of the water shell may be explained in a few words. It is not a projectile of special construction, but simply a common shell or cast iron cylinder filled with water, into which is fitted a small cylinder containing a quarter or, at the most, half an ounce of gun cotton; it is then hermetically sealed; a few grains of fulminate of mercury is placed between the gun cotton and the fuse, and, as soon as the latter is fitted, the shell is ready firing.

The charge of gunpowder used in the same sized shell is sixteen ounces, the explosion of which breaks the shell up into 3 or 4 pieces, whereas the one charged with half an ounce of gun cotton flies into a hundred or more fragments. The reason is this: The gunpowder explodes comparatively slowly, and breaks up the shell at its weak points, while the gun cotton detonates with a sudden and terrible force, which, being communicated to a non-compressible body (water), bursts the shell instantly into minute fragments, the energy being exerted equally on all sides. So rapid and terrible is the force generated by the gun cotton that the iron shell is sometimes pulverized, the fragments of metal being so minute as scarcely to be visible.

The idea of this terrible shell is due to Professor Abel, the scientific referee of the English war department, who is also the patentee of a process to manufacture gun cotton, by which process, it appears from our correspondent's letter, the gun cotton is rendered the safest as well as one of the most powerful of all known explosives; being kept always in a wet state, preventing accident without diminishing its efficiency. The English, German, and French governments have adopted this new form of gun cotton for torpedoes and shells, as well as for military engineering and submarine mining.

Appreciation.

The following are samples of letters frequently received at this office. It would occupy too much space to publish a small fraction of them, but we occasionally, as an acknowledgement to the writers of all such letters that we are not unmindful of their good words, make public one or two of these unsolicited expressions of appreciation. They are mementoes treasured by the recipients, and act as a lubricant to machinery, smoothing the way, and making light the work incident to active professional pursuits:

MESSRS. MUNN & CO.—

GENTLEMEN: Letters patent have been received for our tyre tightener. Allow us to return our thanks for the able manner in which you have conducted our business, in securing our letters patent. And in the future we will remember you to others who may need assistance in securing patents.

Very truly yours, HORTON & HAYES.

McKinney, Texas, August 27, 1875.

RESULT OF AN ADVERTISEMENT.

On the day that the above was received at this office, the following letter, from Senator Randolph, of New Jersey, came to hand:

O. D. MUNN, ESQ.:

It is due to you to say that, of over 300 enquiries about the Ditcher since June, 75 per cent refer to the advertisement of it in the SCIENTIFIC AMERICAN. We have advertised largely in other directions with little success. The single advertisement in the SCIENTIFIC has brought us applications from every State and Territory of the United States, and from Canada, England, France, Belgium, Australia, Brazil, and Buenos Ayres. These are hard, dull times; and I cannot present you with a Ditcher, but can make you feel that, despite the times, people read and heed your good paper.

Yours truly, THEO. F. RANDOLPH.

New York, September 3, 1875.

Opening of the American Institute Fair.

The annual exhibition of the American Institute of this city is now open, and presents a most interesting and attractive display of industrial productions. We shall take occasion to report whatever is new and of interest in the exhibition when order reigns within the building.

THE Chinese alloy called *pakfong* is made by fusing together 10 parts copper shavings and 4 parts arsenic, arranged in alternate layers in a covered crucible, with a layer of common salt on the mixture.

DECISIONS OF THE COURTS.

United States Circuit Court.---Northern District o New York.

THE GOULDS MANUFACTURING COMPANY *vs.* JOHN P. COWING *et al.*—PATENT PUMP.

[In equity.—Before Mr. Justice HUNT.—July, 1874.]

This was a suit in equity, brought upon letters patent for an "improvement in gas pumps," granted to the complainants on the 8th day of August, 1871, as the assignees of William H. Pollard, the inventor. The case came up on exceptions to the master's report, to whom under a previous decree had been sent for an accounting.

The rule is settled that, when the patent is for an improvement upon a machine, the damages for the infringement of such patent are confined to the profits made by the use of the improvement only, and not by the manufacture of the whole instrument.

The complainants, at the accounting, proved the expenses of making and selling the infringing pumps; that they were prepared and ready to fill the orders taken by the defendants, and the prices at which the pumps were sold by the defendants, and the master took the difference between such expenses and such prices (being $47.71 on each pump) as the measure of damages: Held, that as the patent invention was merely an improvement in pumps, being only a special construction of the side chamber, whereby the same is adapted to use with the valve casings bolted on the outside, and constituting but a small part of the aggregate mechanism, this rule was erroneous, and that the damages could not exceed the profits upon such improvement.

The burden of proof, to show the amount of damages or profits, is upon the plaintiff. Where he fails to show the profits or damages arising from the use of the patented improvement, as distinguished from the profits on the entire machine, nominal damages only can be recovered.

[*J. B. Perkins*, for complainants.
Elisha Foote, for defendants.]

Supreme Court of the District of Columbia.

[In General Term.]

FREDERICK G. AND WILLIAM F. NIEDRINGHAUS.—APPEAL.—WHAT CONSTITUTES A DESIGN PATENT.

[In the matter of the application of Frederick G. and William F. Niedringhaus for a patent for a "Design for Ornament for Enameled Iron Ware," filed June 3, 1874.—Appeal from the Decision of the Commissioner of Patents.]

A beautiful appearance is not of itself entitled to a design patent. The design must also be new and original, and the result of invention and genius.

Mere exhibition of skill on the part of workers in enamel, in giving beautiful forms and colors to their productions, when they are the common efforts of persons ordinarily skilled in the art, is not the invention which is protected by the law.

The use of an old design is clearly excluded from patent by the statute, and mere change or "double use" cannot receive its protection.

The same degree of originality is required in both design and functional patents—that is, the claim must not comprehend what is already in existence.

A design consisting in a mere mottled appearance to be given to enameled iron ware is not patentable.

Mr. Justice MCARTHUR delivered the opinion of the court:

This is an appeal from the decision of the Commissioner of Patents refusing a design patent in enameled iron ware to Frederick G. Niedringhaus and William F. Niedringhaus. The statute in regard to design patents reads as follows:

"Any person who, by his own industry, genius, efforts, and expense, has invented and produced any new and original design for a manufacture, bust, statue, alto-relievo, or bas-relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture; or any new, useful, and original shape or configuration of any article of manufacture, the same not having been known or used by others before his invention or production thereof, or patented or described in any printed publication, may, upon payment of the fee prescribed, and other due proceedings had the same as in cases of inventions and discoveries, obtain a patent therefor." (Sec. 4929 United States Revised Statutes.)

In their specification, the applicants claim to have invented and produced a new and original design of ornament or pattern, to be printed, painted, or otherwise placed on, or marked into, the various articles of enameled iron ware which they make and sell. A photograph is annexed to illustrate the outline. They also say that "the article itself, however, when completed, presents to the eye a beautifully mottled appearance, resembling granite in color, which the illustration fails to exhibit. It is this peculiar mottled appearance which constitutes the chief merit of our design, and it is on this we place most importance."

The Primary Examiner, the Examiners-in-Chief, and the Commissioner have all concurred in refusing the application for the patent. The Commissioner, in his decision, says:

"I concur in the opinion of the Examiners-in-Chief, so far as want of patentability in the general subject matter embraced by the application is concerned. The so-called design is effected by printing, painting, or in any other way placing upon iron ware a peculiarly mixed color. The enameling of iron ware in various colors is an art well known. If applicant has achieved anything new, it is to be found in the mixing of colors, by which he produces a mottled appearance having the effect of granite coloring. If he has in this way obtained a new paint, it may or may not be patentable; but the application of such a paint in an ordinary way does not constitute the subject matter of a design patent, even under the most liberal construction of the statute."

The court are unanimously of the opinion that the decision of the Commissioner ought to be affirmed. The art of enameling has been practised for many centuries, and the different kinds of enamel have been produced in every variety of shade and color. The materials used for the purpose of